NEW SPECIES OF GIGANTOPTERIDACEAE

FROM THE LOWER PERMIAN OF TEXAS

Sergius H. Mamay
Department of Paleobiology, Smithsonian Institution
Washington, D.C. 20560

In their article on Upper Paleozoic floral zones and floral provinces, Read and Mamay (1962) recognized two new species of Permian plants, which they designated as "*Gigantopteris* new species A" and "*Gigantopteris* new species B". Inasmuch as that article was of biostratigraphic rather than taxonomic nature, the two new plants served a useful purpose as easily recognizeable guide fossils, notwithstanding the absence of formal names or diagnoses. However, Permian paleobotany has experienced a resurgence in the past decade or so, and recently published references to these unnamed plants indicate the need for formal nomenclatural designations. Accordingly the names *Cathaysiopteris yochelsonii*, n. sp. (for *Gigantopteris* n. sp. B) and *Zeilleropteris wattii*, n. sp. (for *Gigantopteris* n. sp. A) are proposed here.

CATHAYSIOPTERIS YOCHELSONII Mamay, n. sp.

Gigantopteris new species B. Read and Mamay, 1964, p. K15, pl. 19, fig. 2.

Specific diagnosis: Leaves large (to 20cm long), petiolate, dichotomously divided; the two laminar lobes oblong, of equal length (to 18 cm above the point of division of the midrib), to 6 cm wide at the broadest point, with outer sides slightly wider than the inner; margins sinuous to crenate, with sinuses 4 to 15 mm apart; apices of lobes acute with blunt tips; leaf bases acute. Petioles short, stout. Veins pinnate, in three orders. Midrib stout, to 3 mm wide, forking once, well above the laminar base; divisions of the midrib (primary veins) straight, forming an acute angle (app. 30 degrees), each extending to the tip of a laminar lobe. Secondary veins stout, opposite or alternate, slightly decurrent in distal parts of the leaf but mostly straight and parallel; secondaries departing at angles of 30 to 80 degrees with the primary veins, those toward the laminar apex creating the narrowest angle; secondaries 6 to 18 mm apart, each terminating undivided at the convexity of a marginal crenation. Tertiary veins delicate, produced from both sides of the secondaries or directly from the primaries, those of secondary origin departing at angles of 50 to 75 degrees, with the narrowest angles generally formed in distal parts of the leaf, and those of primary origin departing at perpendicular to slightly obtuse angles; tertiaries to 8 mm long, mostly 4 to 6 mm, alternate to opposite, closely spaced at intervals of approximately 0.5 mm, essentially straight and parallel, joining sutural veins at approximately equal intervals; tertiaries mostly undivided but occasionally dichotomizing once, most commonly toward leaf margins and usually occurring shortly beyond the point of departure from the secondary; tertiaries never anastomosing or fasciculate. Sutural veins delicate, one departing immediately above each secondary and bisecting the angle between the secondary and primary, arching outward, then following a straight course parallel to and halfway between the two adjacent secondaries, and terminating undivided at the margin in a sinus or marginal concavity. Those tertiaries proximal to a sutural vein are derived from a secondary vein; the first few distal tertiaries are derived from the primary vein and are succeeded by tertiaries of secondary origin.

Holotype: USNM 41776, Paleobotanical collections of the U.S. National Museum; Read and Mamay, 1964, pl. 19, fig. 2.

Paratypes: USNM 406021-406027.

Geographic, stratigraphic source of type specimens: Quarry on C.O. Patterson property 6 mi. SW of Lawn, southern part of Taylor Co., Texas; SW ¼, S. 436 of M.P. King Survey. Shale in the lower part of the Vale Formation, Clear Fork Group, Leonardian Series, Lower Permian.

Derivation of name: The specific name refers to E.L. Yochelson, who found the holotype.

Comments: The presence of a sutural vein in a system otherwise entailing three orders of venation, the simplicity and close spacing of the tertiary veins, and the long, very narrow meshes between the tertiaries are characteristics of *Cathaysiopteris yochelsonii* that closely resemble the venation of *C. whitei* (Halle) Koidzumi from the Lower Permian of China and Japan, originally described by Halle (1927) as *Gigantopteris whitei*;these resemblances exclude all other gigantopteridaceous species from comparative consideration. The two species are distinguished from each other, however, by the following differences in venation: thesecondary veins of *C. yochelsonii* persist without dividing, to the leaf margin, while those of *C. whitei* lose their identity a short distance from the margin by dividing into several fine, forking veinlets that continue to the margin; the secondary veins of *C. yochelsonii* create angles of 30 to 80 degrees with the primaries, while those of *C. whitei* are mostly perpendicular; angles ofdeparture of the tertiaries measure from 50 to 75 degrees in *C. yochelsonii*, but they are only 30 degrees or so in *C. whitei*; in *C. yochelsonii* each sutural vein originates immediately above the point of origin of the subjacent secondary, but in *C. whitei* the sutural veins originate midway between adjacent secondaries.

Because of the limited and fragmentary nature of available material of these species, a satisfactory comparative appraisal of their gross leaf architecture is not possible. The probability exists, however, that two fundamentally different leaf forms are represented by the fossils. The Texas specimens are all incomplete but the better specimens suggest the dichotomously divided lamina of an otherwise undissected leaf; one specimen of C. whitei, on the other hand, is pinnately compound (Asama, 1959, p. 66).

ZEILLEROPTERIS WATTII Mamay, n. sp.

Gigantopteris new species A. Read and Mamay, 1964, p. K15, pl. 19, fig. 1.

Specific diagnosis: Leaves large (to 32 cm long, 27 cm wide), petiolate, dichotomously divided; the two laminar lobes broad, oblong, of equal length (to 25 cm above the point of division of the midrib), to 13 cm wide at the broadest point, with both sides equally developed; margins very shallowly sinuous or crenate with sinuses 7 to 25 mm apart; apices of the lobes acute with rounded tips; leaf bases rounded. Petiole short, stout (to 6 mm wide). Veins pinnate, in four orders. Midrib stout, to 6 mm wide, forking once, approximately 5 cm above the laminar base; divisions of the midrib (primary veins) stout, separating at an acute angle (app. 50 degrees), slightly bent admedially for a short distance above the point of division, each extending to the tip of a laminar lobe. Secondary veins stout, opposite to alternate, arising 1.0 to 2.5 cm apart, narrowly decurrent for a short distance from the primary, then bending sharply outward, proceeding undivided in a straight course to the laminar margin and usually terminating at the convexity of a crenation; basal secondaries slightly obtuse, the angles of departure decreasing distally to approximately 50 degrees; secondaries parallel near the primaries, becoming more distant toward the margins. Tertiary veins delicate, arising from both sides of the secondaries or directly from the primaries, those of secondary origin narrowly decurrent, then describing angles of 60 to 80 degrees, those of primary origin perpendicular to slightly obtuse; tertiaries alternate to opposite, to 1 cm long, mostly 3 to 7 mm, spaced 3 to 6 mm apart, slightly curved toward leaf apex, parallel, becoming divided toward ends into several quaternary veins that dichotomize sparingly, fuse with similar veins from adjacent and opposing tertiaries or join a weakly developed, zigzag intersecondary sutural vein to form small, narrow, triangular to polygonal meshes. Quaternary veins mostly less than 2 mm long, spaced 0.5 to 1.0 mm apart, forming angles of 35 to 70 degrees; quaternaries dichotomizing sparingly, anastomosing rarely; tips of ultimate veinlets meeting those from the adjacent tertiary or from tertiaries of primary origin at a zigzag, weak or nearly obscure intertertiary sutural vein, forming many narrow, triangular to polygonal meshes. Sutural veins generally less robust than the quaternaries; one intertertiary sutural vein departing directly above each tertiary, bisecting the angle between the tertiary and secondary, arching outward, and joining the intersecondary sutural vein.

Holotype: USNM 41775, Paleobotanical collections of the U.S. National Museum; Read and Mamay, 1964, pl. 19, fig. 1.

Paratypes: USNM 406028-406032.

Geographic, stratigraphic source of type specimens: Old roadcut 225 yards west of U.S. Highway 183-283, 0.4 mi. south of Lake Kemp spillway, 6 mi. north of Mabelle, Baylor Co., Texas. Siltstone in upper part of the Lueders Limestone, Wichita Group, Leonardian Series, Lower Permian.

Derivation of name: The specific name refers to A.D. Watt, who found the holotype.

Comments: With its four orders of venation and both intersecondary and intertertiary sutural veins, the Texas material is clearly referable to the genus Zeilleropteris, proposed by Koidzumi (1936) in his article describing the family Gigantopteridaceae. The type species, Z. yunnanensis Koidzumi, and Z. yujiaensis (Huang) Li and Yao (1983) are the only previously named species of this genus; both are from the Permian of China. Zeilleropteris wattii closely resembles the Chinese species, and only minor differences are apparent in the venation patterns. The type specimen of Z. yunnanensis, first illustrated by Zeiller (1907, fig. 15, 15a), has neither midrib nor margin, and shows only a small area of the leaf, bounded by parts of four secondary veins. The sutural veins are visible, however, and they appear to be straight, while those of Z. wattii are zigzagged; additionally, the meshes of Z. yunnanensis are narrower and directed forward at narrower angles than those of Z. wattii. Z. yujiaensis, originally described by Huang (1980, p. 558, fig. 37) as Gigantonoclea yujiaensis, also differs from Z. wattii in having straight or only weakly curved sutural veins in contrast to the zigzag pattern in Z. wattii. Further, Huang illustrated a nearly complete leaf, showing a large, undivided lamina with irregularly lobed margins. This is in marked contrast to the dichotomous leaf form of Z. wattii, best seen in USNM 406028.

Recognition of the new taxa Cathaysiopteris yochelsonii and Zeilleropteris wattii provides a significant point of generic comparisons between the Permian floras of North America and Asia. The presence of the distinctive venation patterns of Cathaysiopteris and Zeilleropteris in such distantly separated regions is phytogeographically noteworthy. However, these similarities are not paralleled in distribution of gross leaf morphologies. Compound leaves have not been found in the American gigantopterids. Their leaves are undivided, as in Delnortea abbottii Mamay, Miller, Rohr, and Stein (1986), or dichotomously divided, as in Gigantopteridium americanum (White) Koidzumi (1936), Cathaysiopteris yochelsonii, and Zeilleropteris wattii. Among the Asiatic members of Gigantopteridaceae, on the other hand, only one (Aipteris hirsuta Sikstel, 1962) shows foliar dichotomy; all the others are either undivided or pinnately compound.

The summary effects of the nomenclatural adjustments presented here are to establish the presence in North America of two genera of Gigantopteridaceae previously known only in Asia, and to emphasize that the genus Gigantopteris, as treated by Koidzumi (1936), Asama (1959), and others, is not presently known to occur in North America.

REFERENCES CITED

Asama, K. 1959. Systematic study of s-called Gigantopteris. Tohoku Univ. Japan, 2nd Ser. (Geol.) 32(1): 1-72, pl. 1-20.

Halle, T.G. 1927. Paleozoic plants from Central Shansi. Pal. Sinica, ser. A, vol. 2(1): 1-316, pl. 1-64.

Huang, Ben-hong et al. 1980. Paleontological Atlas of Northeast China, vol. 1. Paleozoic. Geol. Publ. House, Beijing.

Koidzumi, G. 1936. The Gigantopteris flora. Acta Phytotaxonomica et Geobotanica, Japan, 5(2): 130-139.

Li Xing-xue, and Yao Zhao-qi. 1983. Current studies of Gigantopterids. Palaeontologia Cathayana 1: 309-326.

Mamay, S.H., Miller, J.M., Rohr, D.M., and Stein, W.E. Jr. 1986. Delnortea, a new genus of Permian plants from west Texas. Phytologia 60(5): 545-546.

Read, C.B., and Mamay, S.H. 1964. Upper Paleozoic floral zones and floral provinces of the United States. U.S. Geol. Surv. Prof. Paper 454-K: 1-35, pl. 1-19.

Sixtel, T.A. 1961. Representatives of gigantopterids and associated plants in the Madygen Series of Ferghana. Palaeont. Zh. (1): 151-158. (In Russian).

Zeiller, R. 1907. Note sur quelques empreintes vegetales des gites de charbon du Yunnan meridional. Annales Mines, tome 10: 5-27.